CUTTLE-FISH "BONES" AGAIN.

By TOM IREDALE.

(Plates iv-v.)

Since my initial venture into the determination of Eastern Australian Cuttlebones, an accession of much material from North and Western Australia has accrued through the enthusiasm of my colleague, Mr. Gilbert Whitley, and my friend, Mr. Melbourne Ward, famed as a crustaceologist. These two, wherever they were, collected cuttlebones, and have provided a good basis for future work on the Australian forms. With Whitley and Ward, I have collected along the Queensland coast and the Great Barrier Reef, and Whitley has collected in Tasmania and Western Australia as well, the bulk of the material here studied being due to his efforts. Mr. Ward collected a nice series at Melville Island, Northern Territory adding a new group to our fauna, a very important one, the genus *Sepiella*. Through Mr. Whitley's collections at Shark's Bay, Western Australia, the puzzle of the miscalled *latimanus* has been solved. Since I wrote, Mr. B. C. Cotton, of the South Australian Museum, has reported upon the Southern forms, ranging from Victoria to South-west Australia, while the Victorian forms have been listed by Miss MacPherson and Mr. Chapple with the aid of the collections of Mr. Allen Carter.

Cuttle-fishes have been described as "littoral," but while they are undoubtedly local, and agree in general with the distribution of littoral mollusca, these animals are met with in the dredge in depths up to one hundred fathoms. Numbers may be secured in a single trawling, and, while the majority may in some cases be of a single species, as many as half a dozen species have been sorted out of one haul, and varied sizes of the one species from small to large may occur together.

Very little is known about the animals, accounts of the superficial examination of the external characters being given, but these are of little significance, save the sucker construction, and the character of the suckers on the clubs of the tentacles. The "bone," however, is very distinctive, and with a little study can be utilised for the separation of species and higher groups, and use of the latter will enable determination of any species, which otherwise may prove difficult. As above noted, the species are local, and thus errors of identification easily suggest themselves. The Southern Australian, that is, extra-tropical Australian, forms have a restricted range, though the tropical ones may be more widely distributed. This, however, is in doubt, as the greater range accredited to the latter may be due to faulty determination. World distribution is curious, as no species occurs in the New World (only two doubtful records exist from the Caribbean Sea), while the Pacific Ocean east of Fiji seems to lack any records; the case of New Zealand will be noted hereafter. From Japanese waters a large number of species have been recorded, and from the Moluccas there seems to be almost as many, but in the latter locality little systematic collecting has taken place.

As previously recorded, it is possible that some "bones," here regarded as merely variations, may, from animal examination, prove to belong to distinct species. The variation in growth with age may differ in apparently closely related species, and this may be seen in animals, but so few animals, in comparison with bones, have been yet criticised. Animals are still being acquired with the hope of providing some stable means of determination, but at the present the bones are the only sure means of differentiation.

It will be noted throughout this paper that Mr. G. P. Whitley has collected more than all the rest of us, and now he has generously provided the illustrations, without which this essay would have had very little value. My thanks are sincerely rendered for his interest in this intriguing group, as he has collected series of both large and small specimens, and the conclusions, here recorded from their study, will be found to be stable when the animals are treated in as much detail.

CLASS CEPHALOPODA.

Cuttlefishes belong to a large class of curious molluscan forms, including the Octopus-like creatures and Squids. Some of the latter are of huge size, a large body with longer tentacles, but Cuttlefishes are mostly small animals. The Cephalopoda are divided into orders, one of which, the Dibranchia, includes the abovementioned

animals. This order is again subdivided into two series, one of which produces eight tentacles, commonly called arms, such as the Octopus; the second, in addition to the normal eight, has developed two much longer, which are retractile, and are used to capture prey by sudden propulsion, making ten in all, as in the Squid and Cuttlefish. These sections were very early discriminated and given sectional names, as the latter two have also developed an internal "backbone" of horny or shelly formation. The names selected were the obvious ones, Octopoda and Decapoda, the "poda" meaning feet, though arms is the word used now. An objection was raised almost simultaneously, and the names, Octocerata and Decacerata, were selected, the "cera" indicating tentacles. As an alternative pair, Polypacea and Sepiacea, were suggested, the very ancient name of the Octopus being Polypus, while Sepia had been also used about the same time for the Cuttlefish and Squid. At the time anyone could introduce names, without any regulations, so another worker added Anosteophora and Sepiaephora for the same two divisions. The names Decacerata and Octocerata were amended to Decacera and Octocera, and the latter pair were used by accurate workers, one reason being the use of Decapoda for a Crustacean group, which had been proposed before the time of the Molluscan Decapoda. Another proposal was Enterostea for the group, Octopoda being retained for the Octopus series. Then still another couple of names was invented, Sephinia and Octopia, the former probably a misprint. All these proposals were published more than one hundred years ago, and the Decapoda or Decacera with Octopoda or Octocera gained usage. Perhaps someone may unearth some other combinations as these sectional names have not been listed as have the generic and specific names, and have been ignored by the law-givers. There would have been no need to recapitulate all these unfortunate mishandlings of the groups had not, twenty years ago, another innovation been added to the long list, Decembrachiata and Octobrachiata, to provide further confusion. This novelty has been used by some recent writers unaware of the facts given above.

For easy reference the propositions are listed below—

1817 Decapoda and Octopoda Leach (Decapoda antedated by the use of Decapoda by Latreille in 1806 for a Crustacean group).
1818 Decacerata and Octocerata Blainville.
1818 Sepicea and Polyacea Blainville.
1821 Sepiaephora and Anosteophora Gray.
1824 Decacera and Octocera Blainville.
1827 Enterostea and Octopoda Berthold.
1830 Decacera and Octocera Menke.
1849 Sephinia and Octopia Gray.
1882 Decacera and Octopoda Verrill.
1890.1902 Decacerata and Octocerata Verrill.
1932 Decembrachiata and Octobrachiata Winckworth.

Apparently the correct name (if Decapoda be rejected) would be Decacerata, but there seems no reason for the rejection of Octopoda, save that of uniformity, in which case Octocerata would come into use.

The earlier references before 1847 will be found in Herrmannsen's Indicis Gen. Malacozorum; the later ones: Sephinia and Octopoda Gray, Cat. Moll. Brit. Mus., Pt. 1 Cephal., p. 2, 1849; Decacera Verrill, Trans. Connect. Acad. Vol. VI, pt. 2, p, 426, 1882; Decacerata and Octocerata Verrill in Webster's International Dictionary 1902, probably in 1890 edition; Winckworth, Journ. Conch., Vol. 19, pp. 248-251, 1932. It may be noted that Octobrachidés and Decabrachidées are also credited to Blainville by Orbigny, but no latinization has been seen.

Solitosepia liliana Iredale.

This was figured and described (15), and proved to be unmistakeable, and so far restricted to the East Coast of Australia. It has been found all along the coast of Queensland as far north as Low Isles, and southward on the New South Wales coast

to Eden. There seems little geographical variation, though the far northern "bones" seem to the eye a little narrower. As to sexual variation, it is not determinable in the "bones," and little is seen to attract attention. The growth stages are of interest, as at about 15-20 mm. all the adult features are recognisable. The very young are however, a little different in shape, lacking the spine, but otherwise show all the specific characters, and the latter remark applies to all the Australian species, which can be easily determined at any stage above 10 mm. in length, and most of them even below that size. The average size was 90 mm. by 45 mm., with the type 114 mm. by 51 mm., the largest one 138 mm. by 65 mm.; it may be noted that the variation is small, and that rarely, as in the instances cited, does the proportion of breadth to length differ much from 1 to 2. A series collected recently varied from 19 by 12, 34 by 19, 53 by 26, 56 by 26, 65 by 30, 64 by 33, 80 by 40, 93 by 46, 100 by 50, 102 by 48, to 109 by 54 mm. Specimens from Northern Queensland range from 38 by 20, 56 by 30, to 82 by 39 mm., while one from Eden, Southern New South Wales, measures 119 by 58 mm.

Solitosepia mestus Gray.

Figured (15) and described (10), the type had been previously figured (13), this is again a distinctive "bone" with a range apparently similar to that of the preceding, reaching into North Queensland, and as far south in New South Wales as Eden, reappearing at Lord Howe Island. At the northern localities, it is however a much scarcer "bone," while only one "bone" has been received from Lord Howe Island. The variation is a little more marked than in the preceding, and there may be more sexual variation, but again this is not seen easily in the "bones." It must be remembered that the "bones" are susceptible to fracture when the animal is alive (how, it is not known), but so many cases are met with that "bones," disagreeing with the mean, must be at once critically examined for fracture, which can be usually recognised. Thus an extra narrow *mestus*, 82 mm. by 29 mm., showed only slight signs of fracture, but the spine was shortened, thickened directly ventrally and split, indicating some mischance in life. The type was 71 mm. by 30 mm., an average specimen, but, by some error, in my first paper the dimensions were all given wrongly, reading "40 by 18 mm. Average specimen figured, 57 by 21 mm." As noted above, the average would be about 70 mm. by 30 mm.; three broad specimens, one from Manly, 92 by 39 mm., another from Eden, the farthest south, 87 mm. by 37 mm., and the third from Bribie Island, Queensland, 90 mm. by 40 mm. The ordinary range of growth reads: 24 by 12, 40 by 18, 55 by 24, 63 by 25, 69 by 27, 90 by 30, 75 by 30, 78 by 34, and 81 by 34 mm., and it should be noted that the broadest part varies in position, sometimes the outer cone being more expanded, and the last loculus lessened. Close to the edges of the last loculus may sometimes be discerned a faint irregular depressed line following the margin but not exactly parallel to it. The significance of the line is not yet known. In the middle of the last loculus there is a depression in the medial line. These features occur in most specimens, more or less marked, throughout the group.

Solitosepia submestus Iredale.

This was described and figured from the Capricorn Group (16), and has been since found in various forms throughout Northern Australia, and distinction of the forms will depend on study of the animals. The Queensland form has been found along the coast of Queensland and the Great Barrier Reef, but a species was called *papuensis* (12) from Station 188 of the "Voyage of the Challenger," the locality being given as Arafura Sea, Lat. 139° 42' E., Long. 9° 59' S., and this point is inside the area fixed as the waters of Queensland in 1877. This may intergrade, but more specimens from intervening localities are necessary. From Western Australia, a "bone" was called *galei* (20) from Shark's Bay, and another, *occidua*, (6), from Rottnest Island. These are of the same type, but the Western Australian form, *galei*, must be accepted at present, *occidua*, however, falling until animals are examined. The "bones" found in the southern part of Western Australia do not appear separable from the Shark's Bay series, though the variation in this species is puzzling. Thus a series from near Bundaberg, Queensland, collected by Mr. and Mrs. R. Page, which initiated this review, is very constant, varying in length from 74 to 89 mm., and in breadth from 28 to 32 mm., the ratio of increase of growth being very regular. The size of the type of *submestus* was given as 68 mm. by

24 mm., and this was the largest at the time, but several longer, as given above, have since been found. Many small specimens, measuring 24 mm. by 9 mm., 24 mm. by 10 mm., and so on, occurred in Queensland waters, but a strange specimen, apparently referable to a distinct species, was secured at Low Isles; this measured 99 mm. by 37 mm., but, in addition to its greater breadth, it was dark coloured and coarsely pustulose, all the other Queensland bones being pale and finely pustulose, and definitely narrower. This may be named *Solitosepia lana* sp. nov. The figure of *papuensis* measures 64 mm. by 22 mm., a narrow form, but Melville Island specimens measured 64 mm. by 23 mm., 68 mm. by 24 mm., 70 mm. by 24 mm., and 71 mm. by 24 mm. The type of *galei* from Shark's Bay, Western Australia, measured 80 mm. by 27 mm. by 7 mm. thick, still narrow, and specimens from that locality range from 38 mm. by 13 mm. up to 110 mm. by 37 mm., the inner cone being consistently narrower than in eastern bones. The type of *occidua*, from Rottnest Island, measured 48 mm. by 19 mm. by 4.5 mm. thick, and a bone collected by Whitley at Garden Island measures 49 by 19 mm., others reaching up to 68 mm. by 26 mm., the inner cone being narrow as in *galei*, and these cannot be separated. As for the consideration of these allied forms, it seems best to admit the named forms, *submestus*, *lana*, *galei* and *papuensis*, as species, in the super-species or group of *papuensis*. The distribution will then read: *Solitosepia papuensis*, from the Arafura Sea, probably at Melville Island and mayhap through Torres Strait; also along the southern coast of New Guinea as far east as the Louisiade Archipelago. *Solitosepia galei*, along the coast of Western Australia from Broome to Rottnest Island, the latter locality the source of *occidua*, which is here regarded as synonymous. (Note: All synonymous names from different geographical areas are in doubt. *Solitosepia lana*, from Low Isles, Queensland, a similar type of bone, but so peculiar as to suggest different animal characters; and *Solitosepia submestus*, described from South Queensland, and ranging northwards up to Low Isles, sometimes all small bones being secured, at others all large, so that possibly two species are confused.

Solitosepia genista sp. nov. Plate V, Figures 17-18.

Whitley collected some bones at Broome, Western Australia, and these were placed with the *galei*, until it was noticed that two species were confused, some bones being *galei*, but others, longer and narrower, represented a new species to Australia. It recalled *singaporensis* (22) from Singapore, but upon comparison it was seen to differ. It is more like the narrow *papuensis*, but the inner cone is not produced: the bones of *galei* occurring with it are typical. The type measures 67 by 23 mm., others varying from 46 by 16, 59 by 23 to 69 by 22 mm., indicating a narrow species. The bone is elongate, narrow, recalling *plangon* in appearance, the inner cone well developed, seen crossing but not obscuring the siphonal cavity, the ventral surface rather flattened, the striated area not deeply excavate, the last loculus long, no ventral sulcus, but a slight indication of a groove medially. The spine is keeled, a little recurved. The dorsal surface is rayed with three rays, forming a median strong rib with the outer radials weakly displayed. The outer cone is slightly calcified.

Solitosepia plangon Gray.

This is another of the curious forms restricted to the East Coast of Australia, but also reaching Lord Howe Island. It has been secured all along the coast of Queensland and the Great Barrier Reef as far north as Low Isles, but becoming very scarce in the northern part of the range. In New South Wales the animal frequents the great inlets such as Sydney Harbour, Botany Bay, Broken Bay, etc., and has not been commonly met with in trawling in deep water. It was described from Port Jackson, New South Wales (10) and figured (15) from Manly Beach. It is unlike any other in its long narrow form with a deep ventral sulcus. No measurements of the type bone were given, and the figured specimen from Manly Beach measured 110 by 30 mm. A northern form, *adhaesa*, was named from the Capricorn Group as being narrower, more elongate, with inner cone more strongly marked, the outer cone passing ventrally in front of the spine, the dorsal surface flatter and the ray sculpture more defined, measurements being given as 88 by 26 mm. Specimens have been collected as far north as Low Isles. However, larger specimens occur along the coast, some from Yeppoon, Queensland, reaching 100 by 28 mm. Similarly, larger specimens have been collected in the south, bones reaching 135 mm. by 35 mm.,

and in these again there is no marked difference between bones to indicate sex, and bones taken from sexed animals do not show any distinction. A series recently collected measured 39 by 13, 42 by 14, 48 by 15.5, 59 by 19, 61 by 19, 72 by 22, 73 by 21, 77 by 23. 82 by 24, and 83 by 25 mm. Most of the northern species of *Acanthosepion* and its associates show the spine to recurve normally, sometimes strongly. It is worthy of note that the northern bones of *plangon* (*adhaesa*) show a tendency to recurve the spine, whilst in the southern *plangon* the spine is very straight.

Solitosepia rozella Iredale.

This figured and described (15), is apparently even more restricted in range than the two preceding. It does not appear as far north in Queensland, though it still reaches the southern coast of New South Wales at Narooma, and has been found at Lord Howe Island. The northern form has been separated sub-specifically, as showing slight geographical variation, but the sexual variation is scarcely indicated in the bones. One of the handsomest of the local cuttlebones, the great development of a ventral sulcus does not appear until the bone is over 30 mm. in length, after which the sulcus shows deeply in the striate area; the non-striate area in a bone of 60 mm. is only 20 mm. from the peak of the sulcus, the striate area being singularly acute. In a bone over 130 mm., the sulcus is very long, the angle of the striate area sharp; the non-striate area being only 30 mm. from the peak. This non-striate area was called the last loculus by Hoyle, and was regarded as a differential character. As it varies with age, and probably with sex, it can only be used as a general indicator with no absolute value. The type measured 135 by 47 mm., larger ones being rarely met with. The northern form, *peregrina* (16), was separated as being smaller, shorter and comparatively broader, the inner cone wider, the dorsal sculpture more pronounced, the type measuring 89 mm. by 34 mm. A normal shell from Manly, 80 mm. long, measures only 29 mm. in breadth. The largest Manly specimen measured 150 mm. by 48 mm., reaching that figure through 34 by 15, 42 by 17, 50 by 20, 58 by 21, 80 by 29, 115 by 38, 130 by 44, and 145 by 45 mm.

Blandosepia baxteri Iredale. Plate V, Figures 12, 13, 14.

A large number of cuttle bones was secured on Lord Howe Island by Mr. Robert Baxter, and it was found that the commonest bone was quite novel, suggesting the New South Wales species, *Solitosepia mestus*, but it lacked the spine. It was named (17), but has not yet been figured. The non-development of the spine seems an important feature. The type measured 74 mm. by 32 mm., the largest at that time being 90 mm. by 37 mm. Bones received since include small specimens as low as 28 mm. by 13 mm. The figured specimen measures 83 mm. in length and 37 mm. in breadth, the range being through 28 by 13 to 90 by 37 mm., measurements reading 44 by 21, 59 by 25, 75 by 34 and 77 by 32 mm.

The bone is elongately oval, the dorsal area finely granulose, showing faintly a dorsal rib and adjacent lines, scarcely separating areas. This is brownish pink, and the outer cone which is produced is whitish, weakly calcified, and bounded by a narrow, horny margin which extends round the bone. There is no spine, but only a slight knob. The inner cone is well developed as a narrow band, reaching in front of the siphonal cavity, and enclosing a striate area. The striated area is long, and, while it does not show any ventral sulcus, there is a shallow median depression with minor ridges each side. The last loculus shows a faint linear median depression and the usual marginal lines. It resembles in most features, as noted above, *Solitosepia mestus*, but as well as the lack of the spine, the dorsal surface shows more definite traces of sculpture than is met with in *mestus*.

The species, so far received from Lord Howe Island, are *Blandosepia baxteri*, *Solitosepia mestus*, *S. plangon*, *S. rozella*, *Glyptosepia opipara*, *G. gemellus*, *Decori-sepia rex*, *Amplisepia apama* (*verreauxi*) and *Crumenasepia hulliana*.

Blandosepia bartletti sp. nov. Plate V, Figures 15, 16.

At my request the Rev. H. K. Bartlett secured a number of cuttlebones at Misima, and the Conflict Group, both in the Louisiade Archipelago. A number of species was included, but the commonest species was a shell recalling *Solitosepia liliana* of New South Wales, but lacking any spine. Since its acquisition, a similar bone has been

described from the Island of Banda in the Moluccan Islands, and given the name of *Sepia bandensis* (3), but that species seems referable to a different source of evolution. The new species may be described thus: Spineless at all stages of growth; in form oval, with calcareous outer cone; it may be classed under *Blandosepia*, but this is only a tentative grouping. The type and figured specimen measures 73 mm. in length and 37 mm. in breadth. Other measurements reading 45 by 20, 45 by 24, 50 by 29, 62 by 29, 68 by 33 and 70 by 34 mm. This resembles the preceding in the dorsal aspect, but there is no dorsal sculpture at all visible. The ventral surface has the inner cone similar, but smaller, and the long striated area shows no signs of sulcus or groove, and is more excavate throughout. The last loculus shows a shallow depression medially, and is never more elevated than the margin. This seems to be a spineless representative of *Solitosepia liliana*, paralleling the previous one and *mestus*.

Mr. Bartlett sent, in addition to the above, some six species, represented by immature and broken bones. *Ponderisepia*, *Crumenasepia*, *Solitosepia papuensis* aff., and a narrower form; also a large square-backed pustulose bone, unlike any other seen by me, but with the posterior end missing; lastly, an elongate, medium-sized bone, also with the posterior end missing, with a faint resemblance to *Sepia sulcata*, but otherwise different from any Australian species. As only a few bones were included in the sending, it is suggested that a large and varied Cuttlefish faunula exists in this locality. It is, at present, hoped to receive Cuttle bones from the Torres Strait area, when the distribution of the species will become clearer, as some of the above species may be found in Australian water. A fragment, recalling the square-backed pustulose bone from Misima, has been picked up at Eagle Island, North Queensland.

Since the above was written, a first consignment has been received from Torres Strait, forwarded by Mr. D. Tranter, of the C.S.I.R.O,, and this shows four expected species: *Solitosepia* of the *papuensis* form, *Acanthosepion ellipticum*, *A. pageorum* (the narrow form) and *Crumenasepia hulliana*.

Mesembrisepia novaehollandiae Hoyle.

This species is involved in a little confusion as it was described (21) from a "bone" collected by Peron at Kangaroo Island, South Australia. The name chosen was *australis*, and it was apparently figured about the year 1826, but the plate was not issued at that date. Six years afterwards (1832), Quoy and Gaimard described and figured (23) a different species under the name *australis* from the Cape of Good Hope. This name is valid. However, about 1845, a series of monographs was begun by D'Orbigny, and continuing his 1826 proposal he retained the name *australis* for the Australian shell and renamed the Cape shell *capensis*. For years the two "*australis*" confused workers, who did not refer to the original data, until Hoyle, recognising the difficulties, introduced the name *novaehollandiae* (14) for the South Australian species. Apparently, more than one form is being classed under this name, and the original description demands a shell 78 mm. long with the breadth 30% of the length, not 30 mm. as sometimes quoted. This is a narrow shell, and no sexual variation has yet been recorded, though some of the variation noted may be due to this cause. The New South Wales representative, *macandrewi* (15) is a broader shell, and there is a slight variation, which may be sexual, in the breadth. It has been urged that the female of some species has a broader shell, but this is not apparent in a few specimens, and in connection with the species *chirotrema*, Berry stated that the body "was relatively much broader and flatter in the male," indicating the difficulty of noting sexual difference. It would be a valuable contribution to study a series of animals and bones from the type-locality, as Berry's data on the animals of "*dannevigi*" (4), which is regarded as the same as *novaehollandiae*, having been collected at the same place, are very confusing. Cotton (7) illustrated a bone 140 by 50 mm., apparently from Robe, South Australia, and observed: "A wide form obtained at Robe is probably the sepion of the female, which is wider across the outer cone and more excavate ventrally." This may be another species.

Mesembrisepia irvingi Meyer. Plate IV, Figures 3, 4.

Meyer described (20) this species from Garden Island, Western Australia, under the genus *Sepia*, and Cotton commented: "This is possibly a variant of *Mesembrisepia*

novaehollandiae Hoyle," also observing: "Among hundreds of specimens from South and West Australia, the numerous variants (of *novaehollandiae*) are not separable into any distinct varieties." The collections made by Whitley suggest that the Western Australian bones, north of the Swan River, are constant enough, in their narrowness and prominent ventral surface anteriorly, to be admitted as different. Consequently, the western name may be used for these bones until the matter is decided absolutely by study of animals. The measurements of the type read 115 by 41 by 13 mm., indicating a narrow shell with an elevated anterior ventral surface, so that the name is applicable. It should be noted also that Meyer gave the total length of the animal as 170 mm., the dorsal length 120 mm., breadth 75 mm., and figured the tentacular club with small suckers and two rows of larger ones, the illustration differing appreciably from that of the tentacular club of *dannevigi* (= *novaehollandiae*) given by Berry. This was described "suckers excessively numerous and minute," "of practically similar aspect."

The bone figured was collected at Point Cloates, Western Australia, measuring 142 mm. in length, 40 mm. in breadth, and 16 mm. in thickness, and may be regarded as typical. A series from Geraldton ranges from 62 by 20, 78 by 24, 104 by 37 to 130 by 40 mm., while the longest is from Pelsart Island, measuring 173 mm. by 45 mm. Many of these specimens have the anterior ventral elevated, some very, and none, from the smallest, shows a somewhat flattened anterior ventral, seen in *ostanes*. There is a shallow median ventral sulcus, which in old specimens becomes pronounced and deep, and slighter sulci show at the sides towards the posterior end. The last loculus is fairly long, much longer than in *ostanes*, and the horny margin is more extensive. The outer cone is somewhat restricted, slightly calcified, and the inner cone is narrow, as a strong glaze extending towards the mucronal area, which is slightly separated dorsally by a granulose area.

Mesembrisepia ostanes sp. nov. Plate IV, Figs. 5, 6.

Mr. G. P. Whitley secured a series from Marrawah and Strahan, West Tasmania, as well as Stanley and Burnie, North-west Tasmania, and these differ very appreciably from typical *novaehollandiae*, so mayhap the animals may differ likewise. The shell shows all the features of the genus, but is broad and with anterior ventral shallow, not elevated. The difference is too marked to be sexual. All these specimens are similar, and the narrowest recall the New South Wales *macandrewi*, while none is as narrow as *novaehollandiae*. The broad bone, with all the characters agreeing, is found along the southern coast of Australia, and round the south-west corner of Western Australia as far as Swan River. It is easily separable by the flattened anterior ventral surface, which shows a round depression. The description of the figured type, which measures 140 mm. in length and 50 mm. in breadth, with a thickness of 10 mm., from Stanley, Marrawah specimens 128 by 45 mm. and 145 by 50 mm., Burnie, 130 by 48 mm. The type has a large expansive outer cone, practically calcified throughout, a thin horny margin round the edges; the inner cone is seen as a thick glaze extending in front of the siphonal area; the striated area very long and showing a lengthened ventral sulcus which peters off into a circular depression reaching to the last loculus, round the inner edge of which will be seen linear grooving, not parallel with the margin. The dorsal surface is pinkish, the outer cone white, the spine short, stout, straight, with a depression behind, coarsely pustulose; the rest of the dorsal surface is very finely granulose, with a broad median triangular area succeeded on each side by a slight flattened band, angularly separated from the rounded sides, which show a slight exposed horny area towards the posterior end. A series of median "bones" from the mainland near Esperance, South-west Australia, show all the differential characters of this species, but are smaller, 90 by 34 mm. to 110 by 37 mm., while among bones collected on the Perth beaches are almost typical bones, one measuring 130 by 46 mm.

A large number of bones has been just received from North Tasmania, forwarded by Mr. R. Kershaw, a grandson of the late well-known Director of the National Museum, Melbourne. These prove very interesting; the most numerous species is *Decorisepia rex*, and there does not appear to be any difference in these from the typical series, measuring 50 by 20 mm., 90 by 30 mm., 111 by 40 mm., 118 by 40 mm. to 123 by 42 mm. A series of *Mesembrisepia* ranges from 110 by 38 mm., 114 by 42 mm., 130 by 44 mm., 138 by 44 mm., 144 by 45 mm. to 150 by 49 mm., thus

becoming very near to *macandrewi*, but not reaching its size. The National Museum, Melbourne, has allowed me to examine the specimens recorded by Chapman from Torquay, Victoria, and the "plesiotype" of *latimanus* proves it to be a *Mesembrisepia* as above noted, the measurements, 138 by 47 mm., coming close again to *macandrewi*. The "plesiotype" of *capensis* is also *Decorisepia rex*, as determined, and others from Nelson's Promontory and Betha River mouth, East Victoria, confirm the non-distinction of the bones from typical *rex*, measuring 28 by 13 mm., 54 by 22 mm., 57 by 23 mm., 64 by 26 mm., 76 by 29 mm., 105 by 39 mm., 117 by 43 mm. to 124 by 45 mm. Thanks must be given to Mr. R. Kershaw and Miss Macpherson, of the National Museum, for their assistance in the elucidation of these matters.

Mesembrisepia macandrewi Iredale.

This species has been described and figured (15), but its exact distribution is not yet determined. It reaches Sydney, N.S.W., as drifted shells, but may occur alive with the other species in the trawl along the coast. It may be found on the eastern Victoria coast, and to the north and east of Tasmania, but the bones from north-west and west of Tasmania are broader, and represent a different form. The western Victoria bones may be *novaehollandiae*, or an intermediate form. The type, from Shellharbour, N.S.W., measured 170 mm. by 56 mm., and this is an average bone. Chapman (5) gave the measurements of a bone, which he named *latimanus*, but the figure shows it to be of *novaehollandiae* form, as 138 mm. by 47 mm. by 13.5 mm. were given as measurements. A series from Stanley, north-west Tasmania, collected by Whitley recall this species, but are a little narrower, ranging from 145 by 45 mm., 155 by 49 mm., 171 by 50 mm., 174 by 51 mm. to 183 by 53 mm.

Mesembrisepia chirotrema Berry.

This South Australian species was described (4) from dredged specimens off Kangaroo Island, along with other specimens regarded as true *novaehollandiae*, as they come from the type locality of that species. Had the bones alone been known, there might have been doubt cast, as they resemble those of *novaehollandiae*, save that they are more elongate and more strongly sculptured. The animals, however, showed valid distinctive features. The bones are not common, so that little can be said about the sexual variation, while the geographical variation is not remarkable. The species has been recorded as far west as Rottnest Island, and Whitley collected bones at Geraldton, and the Abrolhos Group, further north. Little difference can be seen in the bones from these localities when compared with typical bones, but little material has been available. The type bone was imperfect and not measured, but the illustration (reconstructed) of another bone measured 168 mm. by 50 mm., a broader shell than specimens recently measured, Cotton recording from Robe, South Australia, 160 mm. by 42 mm., and the largest from Western Australia 145 mm. by 42.5 mm. A South Australian specimen from Joslin measures 200 mm. by 50 mm. A Western Australian bone from Rottnest Island measured 125 by 40 mm., one from Geraldton 135 by 45 mm. These agree quite closely with South Australian bones, but another from near Cape Leeuwin, measuring 123 mm. by 39 mm., is curious, having more the appearance of *novaehollandiae* on the dorsal surface, save for the presence of a notable median longitudinal rib, and less pronounced tuberculation. The sculpture of the dorsal area is weaker than that of typical *chirotrema*, and the area between the spine, which is short, and the dorsum is level and not so strongly granulose. The inner cone is broader, as is the outer, while posteriorly the ventral surface is elevated. This is almost paralleled by another bone from Pelsart Island, measuring 100 mm. by 38 mm., in all the distinguishing features, the outer cone being slightly less broad.

Amplisepia apama Gray.

This was described from South Australia (10), and ranges round the southern coasts as far north as South Queensland and even Lord Howe Island, while westward it reaches south-western Australia, but is displaced by a distinct form in Shark's Bay. Geographical variation can be seen, and the eastern form has been listed (15) under the name *verreauxi* (24), but animals must be studied to substantiate the distinction. The Lord Howe Island bones are quite fresh, and of varying sizes, showing that the animal lives there, but three bones are recorded from New Zealand, where so far no animals have been found. These New Zealand records seem doubtful, as Powell

has concluded, because the shells are common where the animals live. Sexual variation is not noticeable in the bones examined, varying from minute specimens up to a length of nineteen inches, the breadth being comparatively agreeable to variation in length. Seventeen inches seems to be the average adult size of the bone, but larger have commonly been reported, the largest in hand being nineteen inches, the breadth at that size being nearly seven inches. This huge bone, probably the largest in the world, appears first as a small triangular flattened scrap with little resemblance to the adult, recalling more the *Solitosepia* species. A little later it develops a spine, and, at about 20 mm. long, it recalls a *Solitosepia,* but the short spine points ventrally, not dorsally as in that genus.

The animal has been well described and figured by McCoy (19), and this is copied in Cotton & Godfrey (8), so it is easily accessible.

The shell is elongate, the dorsal surface, almost flat, little rounded, rather smooth, with large chitinous edges showing anteriorly, the anterior portion granulose, prolonged into a long beak, with the spine missing, but the end thickened and rough. The ventral surface is rather swollen anteriorly, sometimes strongly so, with a short unstriated area; striated area with no deep sulcus, but sometimes a shallow median area. The characteristic difference is the prolonging of the outer cone so that the inner cone appears as an elongated glaze only; the limbs bordering the striated area meet and develop a notable warty thickening forming an inverted V.

The variation in sex is not notable, the large bones showing little distinction, and the only feature of interest is the development of the junction of the inner limbs into the quaint warty angle. At first there is no indication, but with growth the reversed V emerges, becoming more warty with age. At the same time the beak elongates at the spinal area, the spine disappearing or leaving an indication only. The spine is sometimes retained until the bone reaches a length of 200 mm., but generally is lacking at a much smaller size. As the beak elongates, the inner cone continues with it, becoming weaker, so that it is only a faint glaze in the largest bones. The eastern bones, known as *verreauxi,* appear to grow to a much larger size with a narrower inner cone, smaller phragmocone and the more prolonged mucronal area. This form ranges into South Queensland and Lord Howe Island as far as bone features are concerned, but the animals may be distinguishable, as Sydney specimens do not agree exactly with the detailed account given by McCoy.

Amplisepia palmata Owen.

Owen (21a) described a large Cuttlefish, captured off the shore of Norfolk Island, as *Sepia palmata,* description of bone not very definite, but the illustrations suggest that the bone be referred to *Amplisepia,* and that it was distinct from *apama.* The figures are stated to be natural size, and this gives the length of the bone as 118 mm., the breadth 39 mm. At this size the beak is well elongated, measuring about 19 mm. from the junction of the inner limbs to the extremity, while no inner cone is shown, nor is there any incrassation at the juncture of the inner limbs indicated. This species so far depends upon the original description, though Brazier added North Coast of Australia, and it is not known what species he had in mind. Nothing like it has been found recently in North Queensland, and the *apama* form found in South Queensland and Lord Howe Island cannot be confused with Owen's species from his description and figures.

Amplisepia parysatis sp. nov. Plate IV, Figs. 1, 2.

The record of floating cuttlebones in Western Australian waters goes back as far as the seventeenth century. W. A. Roosenbergh, near Shark's Bay, on September 17, 1627, noted. "Close inshore we also saw a quantity of cuttlebone, but the pieces were very small and scattered," while Dampier added: "At about 30 leagues distance (from the coast of New Holland) we began to see some Scuttle-bones floating on the water; and drawing still nigher the Land we saw great quantities of them." These remarks may have applied to the present species, but Whitley found floating bones in the Timor Sea which were referable to *Crumenasepia.* Probably more than one large species occur together. The large Shark's Bay species was recorded by Meyer (20), without consideration, as *latimanus* (3), described from Dorey, west New Guinea, and this turns out to be very different, as was anticipated. Whitley brought back a large number of all sizes, and these prove to belong to a distinct species of

Amplisepia. It is smaller, and at all stages a narrower shell, with the posterior end less developed, and retaining the spine until adult. It was mentioned in connection with the introduction of *Mesembrisepia* that the development of that genus suggested a relationship with *Amplisepia*, and the juvenile of the present species is not unlike that of the western species of *Mesembrisepia*, occurring where the ranges overlap.

The general description of the type of *Amplisepia* applies to this species as follows: Length 195 mm. by 70 mm. in breadth. Other measurements are 160 by 58 mm., 187 by 70 mm., 185 by 62 mm., 192 by 70 mm., and the oldest senile bone measures 215 by 78 mm. In this last mentioned the mucronal area is prolonged but thrust forward almost at right angles, quite unlike the area in *apama*. Compared with *apama*, it is a smaller species, notably narrower at every stage of growth, with the striated area less elevated anteriorly and more elevated posteriorly, the last loculus short and depressed. The outer cone is advanced and well calcified, a fairly large horny area being exposed laterally. The spine is always present, and there is no dorsal sculpture nor any ventral sulcus, although sometimes a faint ventral groove may be noticed.

Decorisepia rex Iredale.

This species was described and figured (15) from Manly, New South Wales, and has a somewhat different distribution from the species described at the same time. It does not range far into Queensland, but has reached Lord Howe Island, but similar shells have been named *jaenschi* (7) from Western Victoria and South Australia, and another shell from Rottnest Island, Western Australia, *cottesloensis* (6). This form occurs in northern, southern and western Tasmania also, but there do not seem any tangible differences in the shells so far examined. The most pronounced variation, geographically, is seen in a series from the Capricorn Group, which includes bones much larger than any seen elsewhere. There is some variation in breadth which may be to some extent sexual, but it has not yet been gauged in the bones. Some specimens have the outer cone developed into a broad hood, with others show the hood comparatively small, but the variation in the shell negatives any separation, as some of these differences are due to early (or even late) mishap to the animal. The type, from Manly Beach, measured 119 mm. by 40 mm., while *jaenschi* measured 103.5 mm. by 37 mm. by depth 6.7 mm., and *cottesloensis*, a small specimen, 42.6 mm. by 18.3 mm. by 4.5 mm. Chapman recorded (5) *capensis* from Torquay, Victoria, fortunately giving a figure, so it is recognisable as *Decorisepia rex*, the measurements reading 120 mm. by 42 mm. by 10.5 mm. thick with the spine 6.5 mm. long. The largest New South Wales bones measure 127 mm. by 43 mm., and 124 mm. by 47 mm., but the Capricorn Group bones, which are broken, measure from 140 mm. to 150 mm. with a breadth of 50 mm. Although the inner cone is missing, "coalescing with the edges of the striated area" in most cases, some bones with favourable lighting show a very narrow inner cone as a slight glaze in old shells, not young ones. The very small bones, as 17 mm. by 9.5 mm., 20 mm. by 10.5 mm., 21mm. by 11 mm., and 29 mm. by 13 mm., are recognisable by the adult characters, although the smallest is just starting a spine, and none of these shows the slightest sign of an inner cone. A series collected by Whitley at Stanley, north-west Tasmania, gives very similar measurements throughout, and cannot definitely be separated from *rex*.

As noted under *Mesembrisepia macandrewi*, bones from North Tasmania and east Victoria agree completely with typical specimens of *Decorisepia rex*, and at present cannot be separated.

Glyptosepia opipara Iredale.

This beautiful bone is so far only known from Queensland, drifted bones from New South Wales as far south as Sydney, and Lord Howe Island. It is one of the most brittle of all bones, the majority being broken. It is easily recognisable by its form, its strongly sculptured back and its deep dorsal coloration, with its long spine.

Sexual variation is not notable in the bones, and with the restricted distribution no geographical variation can be seen, while the immature show all the adult features. The description and figure (15) are of a specimen measuring 132 mm. by 42 mm., but many larger bones have been secured. Generally they increase regularly from 63 mm. by 19 mm. to 169 mm. by 45 mm., but some broader shells may be noticed as in the case of such measurements as 151 mm. by 45 mm., and 68 mm. by 22 mm., and 56 by 19 mm.

Glyptosepia cultrata Hoyle.

The story of this species has been given (15), and there is nothing yet to add, but it may be noted that there are some fragments in the Australian Museum regarded as *cultrata* by E. A. Smith at the British Museum, and they are not *gemellus, macilenta* or *hedleyi*. This suggests that, in the confusion of the hauls, there may have been other mistakes, but at present no decision can be made. At any rate, it can be left on the suspense list until the deeper water of the south coast of New South Wales has been fully exploited.

Glyptosepia gemellus Iredale.

After the study of many specimens of bones from the Manly beaches, two species of *Glyptosepia* were admitted, one broad and one narrow. The differences seemed too great to regard them as sexual, and the position remains in this stage at present. The broader shell was named *gemellus* (15), and the narrow form *macilenta* (15), and it has been shown by Cotton (7) that the South Australia species *hedleyi* (4) is also a *Glyptosepia,* and Cotton (6) also recorded this from Western Australia. These records seem to confirm the distinction of the two first named, as the South Australian bones appear to be broad, with the Western Australian ones even broader and larger. The measurements of *gemellus* from Manly are 96 mm. by 35 mm., which is about the same as Berry's reconstruction of one of the bones from the Great Australian Bight. Cotton (7) figured a specimen from Robe, South Australia, only 44 mm. by 15 mm., but illustrated (6) a bone from Cottesloe or Rottnest Island, Western Australia, measuring 107 mm. by 39 mm. by 9 mm., also noting the largest specimen was 120 mm. by 41 mm. by 11.5 mm. thick. Later, Cotton & Godfrey (8) noted the bone was rare on South Australian beaches. Whitley collected bones at Cottesloe and the other Perth beaches, as well as Rottnest Island, and also Pelsart Island in the Abrolhos, and their measurements read 115 mm. by 41 mm., 116 mm. by 39 mm., and 84 mm. by 26 mm. from Rottnest Island, 110 mm. by 39 mm. from Cottesloe, 106 mm. by 39 mm. from the Perth beaches. It will be noted that all these bones are larger and broader than the broadest eastern shells of *gemellus*. The largest Manly bone is 104 mm. by 35 mm., others reaching 95 mm. by 34 mm. and 90 mm. by 34 mm. A large bone, measuring 109 mm. by 35 mm., was collected at the Capricorn Group, South Queensland. No series of measurements is available of South Australian bones, but obviously the Western Australian *hedleyi* is larger and broader, and can be separated on that account.

A series of *Glyptosepia* sent by the National Museum, Victoria, for examination, collected at the Betka River Mouth, east Victoria, appears referable to *gemellus,* measuring 64 by 22, 74 by 24, 75 by 25, 76 by 25, 77 by 25, 77 by 28, 78 by 25, 80 by 25, 85 by 31, 85 by 27, 92 by 32, 91 by 33, 98 by 33 and 98 by 33 mm., figures agreeing fairly well with those of a typical series, but also suggesting the later suppression of *macilenta.*

Glyptosepia macilenta Iredale.

This species was introduced at the same time as the lastnamed. It agreed in most characters, save proportions, and it might have been suggested it was the male of the broad *gemellus*. Many collections made since have shown the differences, but no animals have yet been sexed to prove the matter of the sexes. On this subject it may be noted that when *hedleyi* was proposed on animals, no distinct characters for separating the sexes were indicated, and the broad bone was taken from a male. It should be added that this form approaches nearest the missing *cultrata* in proportions, but *cultrata* was almost as narrow, and it was from a female. The type bone of *macilenta* measured 92 mm. by 28 mm., while the measurements of *cultrata* were 90 mm. by 29 mm. Gray had recorded a bone in the British Museum as *capensis* var.from Sydney, and this was figured and described for comparison, but it was not regarded as *cultrata,* while it is a good illustration of *macilenta,* measuring 85 mm. by 26 mm. Narrow bones have been secured in South Queensland, as also have *gemellus,* but no narrow shells have been seen from Tasmania yet. So until animals are well studied it is best to allow *cultrata* to remain in suspense, and use *hedleyi, gemellus,* and *macilenta,* noting the far west *hedleyi* have larger and broader bones. Measurements of Manly bones referred to *macilenta* may be recorded

as varying from 17 by 9 mm. to 60 by 24, 75 by 26, 79 by 26 to 92 by 28 mm., none reaching to 30 mm. in breadth. Nearly all the Queensland bones belong to the broad *gemellus*, only a couple of solitary bones being referable to *macilenta*, while a bone from Lord Howe Island is also *gemellus*.

Glyptosepia hendryae Cotton.

This is a distinctive bone, described (6) from Rottnest Island, Western Australia, and though it was placed under *Solitosepia* it lacks the characteristic inner cone of that group, and its dorsal surface sculpture is also discrepant. Specimens were collected (singly) by Whitley at Princess Royal Harbour, King George Sound, Pelsart Island in the Abrolhos, and Dirk Hartog Island, as well as at Rottnest Island. These show the anterior end to be formed in the style of that of *Glyptosepia*, and not of *Solitosepia*, and the rest of the characters lean to the former genus, so that until animals are closely studied it will be best to refer the species to *Glyptosepia*. The type measured 77.5 mm. by 22.7 mm. by 6.2 mm. thick, two specimens from Cottesloe measured 51 by 13.5 by 4.2 mm., and 76.5 by 24.2 by 7.3 mm. thick, Whitley's specimens measured: Pelsart Island, 80 by 25 mm.; Princess Royal Harbour, 88 by 26 mm.; Dirk Hartog Island, 93 by 26 mm.; and Rottnest Island, 92 by 26 mm.

Arctosepia braggi Verco.

A notable section of the cuttles, as seen in their bones, includes many very narrow lengthened species which are easily separable at sight. It was suggested that in this section two series could be distinguished, and the name *Arctosepia* was introduced for the small forms found on the New South Wales coast. A larger bone has been named *Sepia braggi* (25) from South Australia, and this larger form is not able to be confused with the typical *Arctosepia* It has been given a range of Victoria, Tasmania, South Australia and Western Australia, and now I add it to the New South Wales faunula, as Whitley has collected a specimen at Narooma, on the south coast. The complex *braggi*, as admitted above, may be capable of subdivision, when studied geographically. Cotton (7) has recorded *braggi* as being common along the coast of South and South-west Australia, the type measuring 60 mm. by 4.75 mm. thick, a Cottesloe specimen reaching 64.5 by 11 by 41.7 (sic) [=4.7]. Chapman has recorded (5) that many scores of the bones of *braggi* were washed up at Torquay, Victoria, at Easter time, 1903, and again at Easter time in 1912, the measurement of the largest specimen being given as 62 mm. by 13 mm. by 5.5 mm., with the spine 2.25 mm. long.

North-western Tasmanian bones, collected by Whitley, grow to a larger size, and are named subspecifically *A.b.xera*, subsp. nov., the type measuring 78 mm. in length and 16 mm. in breadth. This is figured on Plate V, figs. 19, 20, 21. It is obviously larger, and all the specimens agree ranging from 57 by 14 mm., 68 by 15 mm., 73 by 16 mm., 74 by 15 mm. to 80 mm. by 17. A smaller one from Strahan measures 51 mm. by 12 mm., the typical series being from Stanley, North-west Tasmania. Compared with *braggi*, it is more elongate, with a wider posterior area, which shows a median linear groove its whole length, even on the last loculus The dorsal rib is very faint posteriorly, but well indicated anteriorly, while the horny margin is easily seen throughout its length. The posterior horny hood is small.

Arctosepia limata, Iredale.

The species of *Arctosepia* are the smallest of all Cuttlefish bones, and as well as being small, they are quite narrow, and are easily recognisable. This refers to the Australian species, but elsewhere there appears to be two distinct narrow shells, and some are of comparatively large size, and the relationships of these are obscure. It is possible in Cuttlebones that similar bones have developed independently in different areas, and that apparently resembling bones are sometimes not closely related.

The dimensions of this small bone are given as 36 mm. by 8 mm., the type (15) from Manly Beach. Hundreds have been collected, but the majority have been broken, as the bones are brittle, while none exceeding these measurements has been collected in the Sydney district, and specimens have been secured on the north coast of New South Wales, and South Queensland. These small bones may

occur further north, as they are easily overlooked, and the northern bones might belong to different species. A bone was picked up at Low Isles, but was not secured by me, and its exact identity is unknown. This small species has been listed from Victoria by Macpherson and Chapple (18).

Arctosepia versuta, Iredale.

Many specimens were secured on Manly Beach, New South Wales, of a bone differing at sight, but not much in measurements, the type giving 33 mm. by 7 mm. (15). It is probable that the animals may show greater distinction than the bones, as varied accounts have appeared about the animals referred to the apparently allied genus *Doratosepion*. In Southern Australia, large shells (for the group) occur with the name *braggi*, and it would appear that these small New South Wales shells are degenerate representatives of the larger ones. Thus, Whitley collected a series of *braggi*-like bones in North-western Tasmania, and while most of these are obviously of the true *braggi* style, some others are of the *versuta* form, and appear to be far larger relatives. In order to attract attention this is here named, as it may occur on the Western Victorian and South Australian shores. The northern *versuta* was separated from *limata* as being "smaller, the growth lines more closely packed, the posterior end much less rapidly tapering, the anterior ventral more swollen, less excavate posteriorly, and with more numerous striae."

The Tasmanian specimens measure 51 by 10 mm. and 48 by 10 mm., and are elongate and narrow, the width never increasing rapidly, the ventral surface elevated, the median furrow in one specimen elevated into a rib, in the other normal, the striae rather coarse, the hood small, the spine short and thickened, the dorsal area smoothish, the median rib scarcely indicated. This may have been confused elsewhere with *braggi*, passing as the male or immature, but it is here named *Arctosepia treba* sp. nov., from Stanley, North-western Tasmania.

It should be noted that bones of the *Arctosepia* type, referred to *Doratosepion*, have been taken from animals showing quite distinctive features, so that this may be the case in Australia also.

Arctosepia rhoda sp. nov. Plate iv, figs. 10, 11, 12.

All southern specimens of *Arctosepia* have been regarded as *braggi*, including those from Western Australia, but probably two or three forms are there represented. Meyer (20) received an animal from Garden Island, and figured the bone with the posterior end missing. The remainder measures 35 mm. by 8 mm., suggesting a small specimen. Whitley secured a few bones, but only one is worthy of recognition, as it is definitely not *braggi*, and is here named as new. It was collected at Point Cloates, Mid-western Australia, and measures 52 mm. long, 12 mm. broad, and 6 mm. in thickness. It will be seen from the figures how different this species is, having a comparatively short, broad posterior area, well elevated and showing, instead of a linear groove, a raised rib along the striated area, but the linear groove appears in the last loculus. Practically the whole ventral area, save the extremities, is elevated. The dorsal area is comparatively smooth, with a narrow median elevated rib, and with a large amount of horny margin on the sides exposed. The spine is of the usual rounded style, while the hood is small. Altogether it is unmistakeable.

Cotton (6) recorded a Cottesloe specimen of *braggi* as 64.5 mm. by 11 mm. by 41.7 (sic) mm. [=4.7], and the above is obviously separable from the measurements alone.

Tenuisepia mira, Cotton. Plate v, figs. 7, 8 .

This beautiful little bone, described from the Capricorn Group, Queensland (7a), is very fragile, and broken bones have been found as far north as Low Isles, while it has been collected in New South Wales at Trial Bay by Melbourne Ward. So far it has no known relative in the Australian series. The type measured 55 mm. in length, 10.6 mm. in breadth, and 4 mm. in thickness. The specimen, here figured, was collected at Trial Bay, New South Wales, by Mel. Ward, and measures 48 mm. by 10 mm. It is small, elongate, five times as long as broad, with the inner cone coincident with the inner limbs; the spine is not keeled, and the dorsal surface is finely pustulose, almost smooth, and there is no ventral sulcus.

Acanthosepion whitleyanum, Iredale.

This tropical species was described (15) from Port Macquarie, New South Wales, but it is not known whether it lives in New South Wales waters. Drifted bones have occurred as far south as Sydney, but it has been commonly found on the Queensland Coast and the Great Barrier Reef. A notable feature of this species is the broad smooth band at each side of the striated area, the broad shallow sulcus of this area occupying more than half its breadth, while there is a very short non-striate area or last loculus. The characters seem to be common to the species of *Acanthosepion (sensu lato)*. The type measured 168 mm. by 56 mm., and in the figure the broad band at the side is not emphasized. Another notable feature is the constant recurving of the spine, which sometimes is seen split on the dry bone, even as in the allied *Crumenasepia*. Mel. Ward collected a fine series, opposite Bribie Island, Queensland, ranging from the typical measurement to the fine size of 235 mm. by 78 mm. In drying, as noted previously, the horny covering at the base of the spine contracts, and causes the spine to break off, carrying the horny hood with it. A series from Michaelmas Cay measured 26 mm. by 10 mm., 30 mm. by 14 mm., 34 mm. by 18 mm., 43 mm, by 20.5 mm., 50 mm, by 21 mm. to 90 mm. by 34 mm., 102 mm. by 41 mm., and 114 mm. by 42 mm. Thence as above from 168 mm. by 56 mm. to 235 mm. by 78 mm. The smallest show the characteristic thickening of the inner cone, but not until over 30 mm. does the chitinous hood appear.

Acanthosepion pageorum sp. nov. Plate iv, figs. 7, 8, 9.

When large collections of bones were made at various points in Queensland, on the coast and the Great Barrier Reef. a bone similar in most respects to the preceding one was noted and easily separated, though superficially it agreed in most features. Some shells are notably narrower than others, but whether this is sexual or not is unknown. When a common species is well known it has been found that the sexual variation is small and inconstant, and bones cannot be separated into male and female. Apparently in the species of *Acanthosepion* and allied genera there are, however, in many cases, narrow and broad shells, and until animals are studied in series no decision can be made. At the present these are not separated, but regarded as belonging to one species, although this conclusion is open to doubt.

Shell medium, elongately oval, anteriorly a little narrowed, more than twice as long as broad, striated area very long, leaving only a short "last loculus," the striated area being depressed medially into a broad shallow sulcus more than half the whole breadth of the area, which is bounded on each side by a smooth band; the differential feature separating this from *whitleyanum* is the development of the inner cone into a cup-like, smooth-edged, calcareous rim, which is built up of layers as the shell grows, but is present in the very small bones. The dorsal surface is coarsely pustulose and is scarcely separable from that of *whitleyanum*, save that a median rib is obsoletely seen; this rib may be noted in small *whitleyanum*, but is missing in the larger shells; a large chitinous edge is exposed, and the outer cone is covered with a chitinous hood, which does not surround the spine, so that this is not detached in drying. The spine is strongly recurved and round as in *whitleyanum*. The type, from Keppel Bay, Queensland, measures 135 mm. in length by 50 mm. in breadth; a series from Lindeman Island, Queensland, measuring 58 by 24 mm., 90 by 33 mm., 124 by 42 mm., and 146 by 51 mm. The bone collected by Mr. and Mrs. R. Page at Bucasra Beach, near Mackay, Queensland, measured 110 mm. by 43 mm., and is not used as type, as the horny hood is glistening white, and may even represent a different form, for all the others from Queensland, which have been collected at eleven localities, show a yellow hood.

As above noted, bones vary in breadth, so that the differentiation into forms must be left to the examination of animal features. Thus, the species has been collected at Melville Island, Northern Territory, Timor Sea, Broome, North-west Australia, Port Cloates, North-west Australia and Shark Bay, the Western specimens collected by Whitley. The Timor Sea bone, found floating, is a narrow one, measuring 120 mm. by 39 mm., while the Point Cloates specimen is a broad

one, measuring 140 mm. by 50 mm., an immature from Shark Bay measuring 60 mm. by 25 mm.

Acanthosepion ellipticum, Hoyle.

Hoyle described (12) this species from "Challenger" Station 188 in the Arafura Sea, but included in Queensland waters. It is a small species for the series, and is remarkable for the formation of the inner cone which produces a cup-like effect, but the outer edge of the cup is thin and almost, as it were, hinged in front. This is so different from the other forms of *Acanthosepion* that a sub-genus *Fiscisepia* (16) has been introduced for it. The bones from the Capricorn Group, at the southern end of the Great Barrier Reef, were found to be larger and the dorsal sculpture less pronounced, and as the variation of the form was unknown, were given a sub-specific name *adjacens* (16). Specimens have been secured at all collecting grounds from Keppel Bay northward in Queensland as well as in the Pellew Group, Gulf of Carpentaria; Melville Ieland, Northern Territory, and along the north-west of Australia as far south as Broome. Measurements of the bone of the type specimen were not given, but the figure (13), natural size, measures 72 mm. by 31 mm., while that of *adjacens* was 105 by 46 mm. Large collections, since received, allow more measurements, the largest of a large series from Melville Island measuring from 47 mm. by 20 mm. to 97 by 37 mm., 98 by 42 mm. and 99 by 43 mm. A series from Low Island, Queensland, ranged from 49 by 23 mm. to 99 by 45 mm., to 101 by 45 mm., and 106 by 44 mm. Three from Broome, Western Australia, measured 68 by 32 mm., 80 by 35 mm., and 80 by 37 mm., thus approaching nearer the measurements of the typical form.

A collection of cuttlebones made recently by Mrs. Joy Kerslake at the Clarence River beaches included a specimen of *A. e. adjacens*, a new record for New South Wales.

Acanthosepion glauerti, Cotton.

The description and figure (6) of this species from Rottnest Is., Western Australia, suggests that it might be an immature of a species of *Acanthosepion*. The general characters of the genus are displayed in the figures given by Cotton. No specimens have yet been recognised in Whitley's collection, which indicates that it might be a wanderer south only. The type was 50 mm. by 23 mm., and 6 mm. thick.

Acanthosepion smithi, Hoyle.

This is another of the species described (12) from "Challenger" Station 188 in the Arafura Sea, but this one has not yet been recognised. Adam (3) has made the name a synonym of *aculeata*, which from the figure and description it certainly is not. These species (of *Acanthosepion*) do not differ from the juvenile to the adult. The immature of *aculeata* shows an inner cone cup, as in the adult, but *smithi* does not show any signs of such a cup in the figure (13). However, the description states that the inner cone is well developed, with a thickened rounded margin, enclosing a deep pit. The type was not measured, but the measurements of another bone were given as 84 mm. by 30 mm.

Crumenasepia hulliana, Iredale.

The large corneous inner cone was given as the distinctive feature of this group, when the species was described (16) from North Queensland, while it was noted from the Capricorn Group, and the Pellew Group in the Gulf of Carpentaria. Later Cotton added an allied form (6) from Cottesloe, Western Australia, naming it *C. ursulae*, and specimens have been seen from Geraldton, and also from the Timor Sea, Whitley collecting some floating bones in the lastnamed locality. Mel. Ward also secured it at Melville Island, Northern Territory. The eastern form has been received from Lord Howe Island and New Caledonia. Adam (1) has lumped all the species of *Crumenasepia* under the name *rouxii*, given to a bone from Bombay, India, supposing a range from Somaliland to Japan, although differences have been recorded in the animals from various localities, and names proposed by efficient students.

The type of *hulliana* from Howick Island measures 180 mm. by 65 mm., and all

sizes from 53 by 20 mm., 120 by 39 mm., 120 by 44 mm., reaching over 220 mm. by 75 mm. have been measured.

In the very small ones the corneous inner cone is present and recognisable. Whitley collected some very large bones of *ursulae* at Geraldton measuring 290 mm. by 107 mm.

Ponderisepia eclogaria, Iredale.

This large shell was decsribed (16) from the Capricorn Group, South Queensland, and noted from North Queensland, New Caledonia, New Hebrides and Fiji. This species has been synonymised with *latimanus* and *hercules* by Adam (3), but it does not agree with the description of *latimanus*, and it is a smaller shell, with minor differences, than *hercules*, a Japanese species. No long series has been secured from the various localities, but, in the few bones available, the Fiji bone suggests separation. The type measured 326 mm. by 128 mm., and is almost the limit so far seen, one reaching 330 by 130 mm., others ranging from 120 by 43, through 130 by 45, 190 by 65, and 240 by 90 mm., in a series collected by Mel. Ward in Queensland. Although Whitley collected extensively in Western Australia, he did not find any specimens, neither did Mel. Ward in North-western Australia.

Metasepia pfefferi, Hoyle.

The formation of the bone in this genus is quite unlike that of any other *Sepia*, being small and diamond-shaped. It was described (12) and figured (13) from Station 188 of the cruise of the "Challenger," just inside Queensland waters, west of Torres Strait, and the broader shell found at the southern end of the Great Barrier Reef, the Capricorn Group, was given a sub-specific name *laxior* (16). It has been found at other places along the Queensland coast, at Stradbroke Island, North Keppel Island, Lindeman Island, Michaelmas Cay and Low Isles while Whitley collected specimens at Denham Bay, Shark's Bay, Western Australia. At the introduction of *laxior*, it was mentioned that Hoyle's type measured 45 by 24 mm., while the three *laxior* were 51 by 32, 36 by 24, 27 by 16 mm.; "also that the largest showed a calcification suggesting formation of a spine." The collections abovementioned show the presence of a spine, but it is scarcely calcified, the chitonous dorsal covering being produced as seen in the figure. This genus is the only one yet known which shows the retention of the chitin, which is seen only at the edges in the rest of the group, uncovered by calcination. In some genera such as *Ponderisepia* the calcine covering is thick, and can be flaked off, but in others, as *Amplisepia*, it is so thin that it is almost fused with the chitin.

The Denham Bay form, figured on Plate v, figs. 9, 10, 11, may be called *M.p. wanda*, subsp. nov. The specimen figured is a small one measuring 32 mm, by 20 mm. with 8 mm. in depth. The long horny spine is shown, and there is no calcification present, but a larger one shows a very slight touch, but not as much as in the eastern form. The western one, moreover, shows little calcification of the inner limbs, while in the eastern the inner limbs are well calcified. The ventral surface becomes more swollen with age and size, and a deep median furrow is developed. A larger specimen measured 38 mm. by 23 mm., while a specimen from Stradbroke Island, South Queensland, measured 43 mm. by 27 mm.

Sepiella melwardi sp. nov. Plate v, figs 1-6.

The bones of the group known as *Sepiella* are notably different from any of the *Sepia* bones, and there appears to be a number of species, not one, as claimed by some workers. Species have been named from various places, from the Red Sea to the Moluccas, and the animals have been reviewed by Adam (3). The animals are superficially similar to those of other Cuttlefishes, but the anatomy differs, a superficial character being the existence of a glandular pore at the posterior extremity between the fins. The bone differs at sight in the production of a chitinous fan at the posterior end, and there seems to be a wide difference in the bones, attributed to sexual features. Adam (3) has reviewed the named species, amalgamating some forms irrespective of geographical distribution and then naming a new species, *S. weberi* from the Moluccas. This was a small species, the male bone measuring 57.5 mm. by 17 mm. by 7 mm. thick, with the

last loculus 21 per cent. of the bone, the female bone measuring 67 mm. by 20.5 mm. by 7 mm. thick, with 25.5 per cent. for the last loculus.

Melbourne Ward collected at Condon Bay, Melville Island, Northern Territory, over fifty bones, mostly broken posteriorly, but all of them, when complete, would be smaller than the above figures They are roughly separable into two series which are here accepted as male and female, the smaller (male) showing a notch in the horny posterior fan, the larger (female) lacking such a notch. The type female measures 53 by 18 mm. by 6.5 mm. thick, and the male 44 mm. by 14 mm. by 6 mm. thick. The figures are explanatory, the dorsal area being medially ribbed, being much more curved in the female, in which the horny fan is more extensive. The female is much wider and proportionately less elevated, the last loculus also varying, being much longer in the female. There is a slight circular depression toward the end of the last loculus in the female, while it is larger and more notable in the male.

An animal was dredged in 40 fathoms S.E. of Lesueur Island, North-western Australia, and the bone was decalcified by the preservative, but it almost certainly will belong to this species.

Rejected Species.

Two Indian species have been recorded from Australia, *Sepia Indica* Orb, and *S. rostrata* Orb. Neither occurs, the records being based on *Acanthosepion*-like species. In a note on southern India *Sepia,* Winckworth recognised three species of the genus as being common, with a new one of which only two specimens had been found, while *Sepiella* was also abundant. Hornell (11) stated that during the months of February-March bones occurred so numerously that "a woman can collect several hundreds a day." Winckworth (27) admitted. "*Sepia rouxii* with three syonyms; *Sepia aculeata* of which *indica* had a narrower shell; and *Sepia rostrata,* which has also two forms." The new species was named *S. prashadi,* without comparing it with its apparent congeners. Now Adam (2) has named the "*rostrata*" shell of Winckworth, as different, calling it *winckworthi,* but also included *smithi* as a synonym of *aculeata,* though the illustrations are nothing much alike.

The African species, *capensis,* has also figured in connection with Australian bones, but does not occur here. The correct specific name is *australis,* and while sometimes *Glyptosepia* bones have been mistaken, at others very unlike bones, as those of *Decorisepia rex,* have been referred to *capensis.*

The Southern Australian bones sometimes appear from figures to resemble closely South African species, but no close relationship of animals has yet been established.

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EXPLANATION OF PLATES.

Plate iv.

	Length.	Breadth.	Thick.	
Figs. 1 & 2—*Amplisepia parysatis* Iredale	195 mm.	70 mm.		Type
Figs. 3 & 4—*Mesembrisepia irvingi* Meyer	142 mm.	40 mm.	16 mm.	
Figs. 5 & 6—*Mesembrisepia ostanes* Iredale	140 mm.	50 mm.	10 mm.	Type
Figs. 7, 8, 9—*Acanthosepion pageorum* Iredale	135 mm.	50 mm.		Type
Figs. 10, 11, 12—*Arctosepia rhoda* Iredale	52 mm.	12 mm.	6 mm.	Type

Plate v.

	Length.	Breadth.	Thick.	
Figs. 1, 2, 3—*Sepiella melwardi* Iredale	53 mm.	18 mm.	6.5 mm.	Type
Figs. 4, 5. 6—*Sepiella melwardi* Iredale	44 mm.	14 mm.	6 mm.	
Figs. 7, 8—*Tenuisepia mira Cotton*	48 mm.	10 mm.		
Figs. 9, 10, 11—*Metasepia pfefferi wanda* Iredale	32 mm.	20 mm.	8 mm.	Type
Figs. 12, 13, 14—*Blandosepia baxteri* Iredale	83 mm.	37 mm.		
Figs. 15, 16—*Blandosepia bartletti* Iredale	73 mm.	36 mm.		Type
Figs. 17, 18—*Solitosepia genista* Iredale	67 mm.	23 mm.		Type
Figs. 19, 20, 21—*Arctosepia braggi xera* Iredale	78 mm.	16 mm.		Type

CHECK LIST.

Class CEPHALOPODA.

Sub-class DIBRANCHIA.

Order DECACERATA (DECAPODA)

Family SEPIIDAE. Sub-family SOLITOSEPIINAE.

Solitosepia liliana Ired. 1926.—N.S.W., Q.
Solitosepia mestus Gray 1949.—N.S.W., Q., L.H.I.
Solitosepia papuensis Hoyle 1885.— N.Q., N.T.
Solitosepia submestus Ired. 1926.—Q.
Solitosepia lana Ired. 1954.—N.Q.
Solitosepia galei Meyer 1909.—M.W.A.
Solitosepia occidua Cotton 1929.—S.W.A.
Solitosepia genista Ired. 1954—N.W.A.
Solitosepia rozella Ired. 1926.—N.S.W.
Solitosepia rozella peregrina Ired. 1926.—Q., L.H.I.
Solitosepia plangon Gray 1848.—N.S.W., L.H.I.
Solitosepia plangon adhaesa Ired. 1926.—Q.
Blandosepia baxteri Ired. 1940.—L.H.I.
Blandosepia bartletti Ired. 1954—Misima, Louisiade Archipelago.
Mesembrisepia novaehollandiae Hoyle 1909=*dannevigi* Berry 1918.—S.A., Vic., Tas.
Mesembrisepia irvingi Meyer 1909.—S.W.A.
Mesembrisepia ostanes Ired. 1954.—N.W. Tas., S.A., S.W.A.
Mesembrisepia macandrewi Ired. 1926.—S.N.S.W.
Mesembrisepia chirotrema Berry 1918.—S.A., S.W.A.
Amplisepia apama Gray 1849.—S.A., Vic., Tas., S.W.A.
Amplisepia verreauxi Rochebrune 1884.—N.S.W., S.Q., L.H.I.
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Glyptosepia opipara Ired. 1926.—N.S.W., Q., L.H.I.
Glyptosepia cultrata Hoyle 1885.—S.N.S.W.
Glyptosepia hedleyi Berry 1918.—S.A., S.W.A., W. Tas.
Glyptosepia gemellus Ired. 1926.—N.S.W., S.Q., Vic., E. Tas., L.H.I,
Glyptosepia macilenta Ired. 1926.—N.S.W., S.Q.
Glyptosepia hendryae Cotton 1929.—S.W.A.

Sub-family DORATOSEPIONTINAE.

Arctosepia braggi Verco 1901.—S.A., Vic., S.N.S.W., N. Tas., W.A.
Arctosepia braggi xera Ired. 1954.—N.W. Tas.
Arctosepia limata Ired. 1926.—N.S.W., S.Q., Vic.
Arctosepia versuta Ired. 1926.—N.S.W.
Arctosepia treba Ired. 1954.—N.W. Tas.
Arctosepia rhoda Ired. 1954.—M.W.A.

Sub-family TENUISEPIINAE.

Tenuisepia mira Cotton 1932.—Q., N.N.S.W.

Sub-family ACANTHOSEPIONTINAE.

Acanthosepion whitleyanum Ired. 1926.—N.S.W., Q.
Acanthosepion pageorum Ired. 1954.—Q., N.T., W.A.
Acanthosepion glauerti Cotton 1929.—S.W.A.
Acanthosepion smithi Hoyle 1885.—N.Q.,
A. (Fiscisepia) ellipticum Hoyle 1885.—N.Q., N.T., W.A.
A. (Fiscisepia) ellipticum adjacens Ired. 1926.—S.Q., N.N.S.W.
Crumenasepia hulliana Ired. 1926.—Q., N.T., L.H.I,
Crumenasepia hulliana ursulae Cotton 1929.—S.W.A.
Ponderisepia eclogaria Ired. 1926.—Q.

Family METASEPIIDAE.

Metasepia pfefferi Hoyle 1885.—N.Q.
Metasepia pfefferi laxior Ired. 1926.—S.Q.
Metasepia pfefferi wanda Ired. 1954.—N.T., N.W.A.

Family SEPIELLIDAE.

Sepiella melwardi Ired. 1954.—N.T., N.W.A.

Key to Abbreviations.—E. Tas., eastern Tasmania; L.H.I., Lord Howe Island; M.W.A., mid-western Australia; N.N.S.W., northern New South Wales; N.Q., north Queensland; N.S.W., New South Wales; N.T., Northern Territory; N.W.A., north-western Australia; N.W. Tas., north-western Tasmania; Q., Queensland; S.A., South Australia; S.N.S.W., southern New South Wales; S.Q., southern Queensland; S.W.A., south-western Australia; Tas., Tasmania; Vic., Victoria; WA,. Western Australia; and W. Tas., western Tasmania.

All the references necessary may be traced through the reference list here given The distribution of the species in the different States is not yet well known, the number of species recorded being as follows: New South Wales, 17; Queensland, 20; Victoria, 7; Tasmania, 7; South Australia, 7; Western Australia, 18; and Northern Territory, 5. As Torres Strait and the Northern Territory have not yet been thoroughly explored for these bones, probably most additions will be made from these localities. All the types and series studied are in the Australian Museum, the new names proposed in this paper being *Solitosepia lana, S. genista, Blandosepia batletti, Mesembrisepia ostanes, Amplisepia parysatis, Arctosepia braggi xera, A. treba, A. rhoda, Acanthosepion pageorum,, Metasepia pfefferi wanda,* and *Sepiella melwardi.*

BOOK REVIEWS.

"General Zoology," by Tracy I. Storer Second Edition, 1951; pp. 1-832+xii. Profusely illustrated. McGraw-Hill Book Company, Inc., New York. Price, £3/4/3.

This second edition of Storer's "General Zoology" brings up to date and improves a textbook that is already deservedly popular in many countries. The book is arranged in a simple, clear fashion, and is well illustrated, so that it is especially suitable for anyone studying zoology for the first time.

Professor Storer uses the classical approach to the subject. In part I he deals in some detail with the frog, as a representative animal, and then passes to a brief but excellent survey of comparative animal biology. This leads naturally to discussion on heredity, genetics, ecology, distribution and evolution. The history of zoology is also dealt with most interestingly, and the first section of the book concludes with a clear account of animal classification and nomenclature.

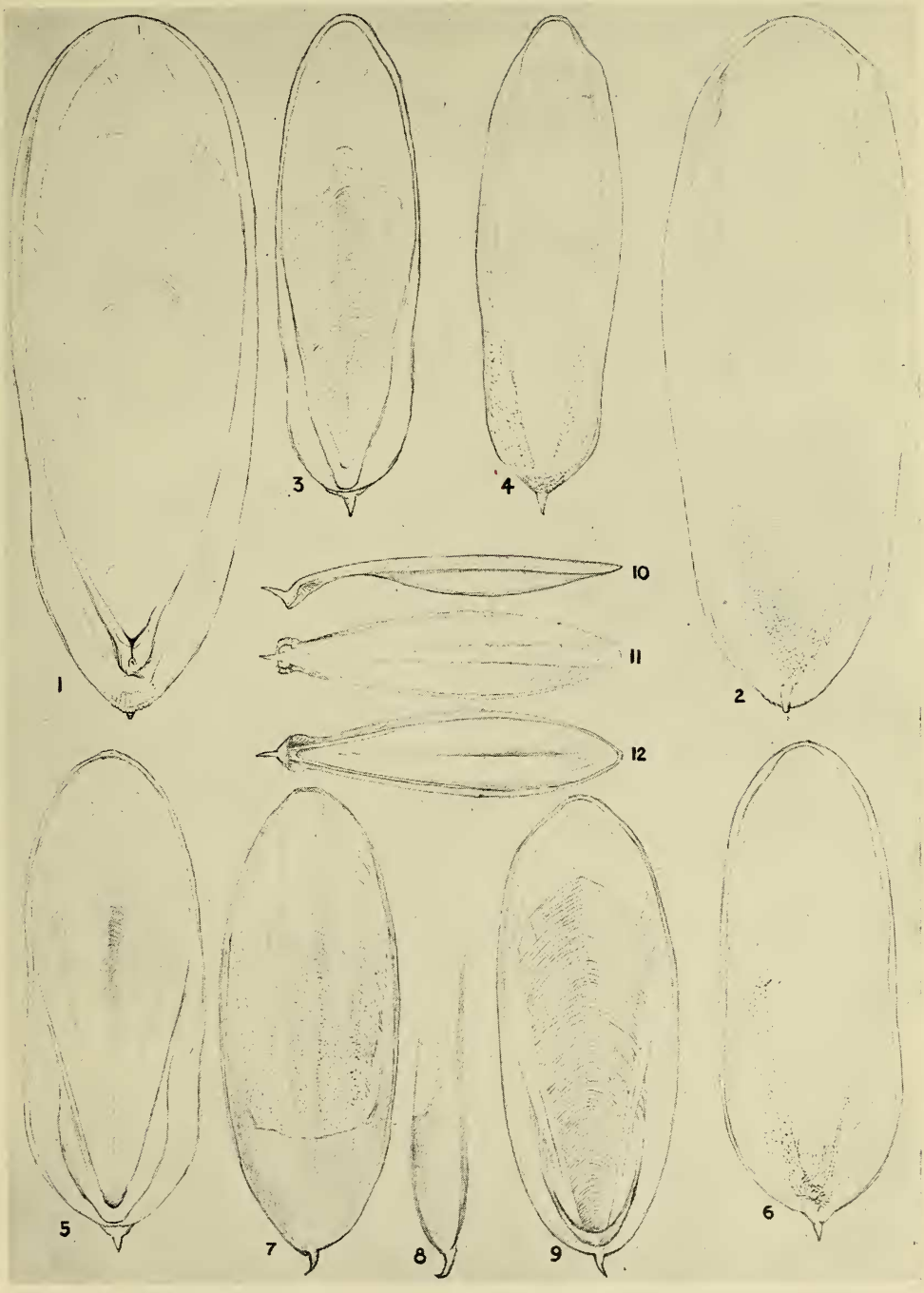
The second and larger section of the book is devoted to a survey of the animal kingdom, and gives a synopsis of this fascinating subject in a surprisingly small space. The illustrations in this section are excellent and deserve special mention, since they would be such a help to the beginner trying to classify his collection. Some of the obscure and smaller groups, generally omitted from elementary text-books as being too difficult for a beginner, are most clearly explained, so that the conspectus of the animal kingdom is complete. Because of this, the book is an excellent one for the amateur naturalist and a splendid reference book for school and private libraries. It can be recommended for any zoologist from school grade to senior University standard.

—E. Pope.

"Bees of the Portland District." By Tarlton Rayment. 8vo. Published by the Portland Field Naturalists' Club, Victoria, Australia, on the Coronation Day of Queen Elizabeth II, June, 1953; pp. 1-39, 1 pl., 3 figs.

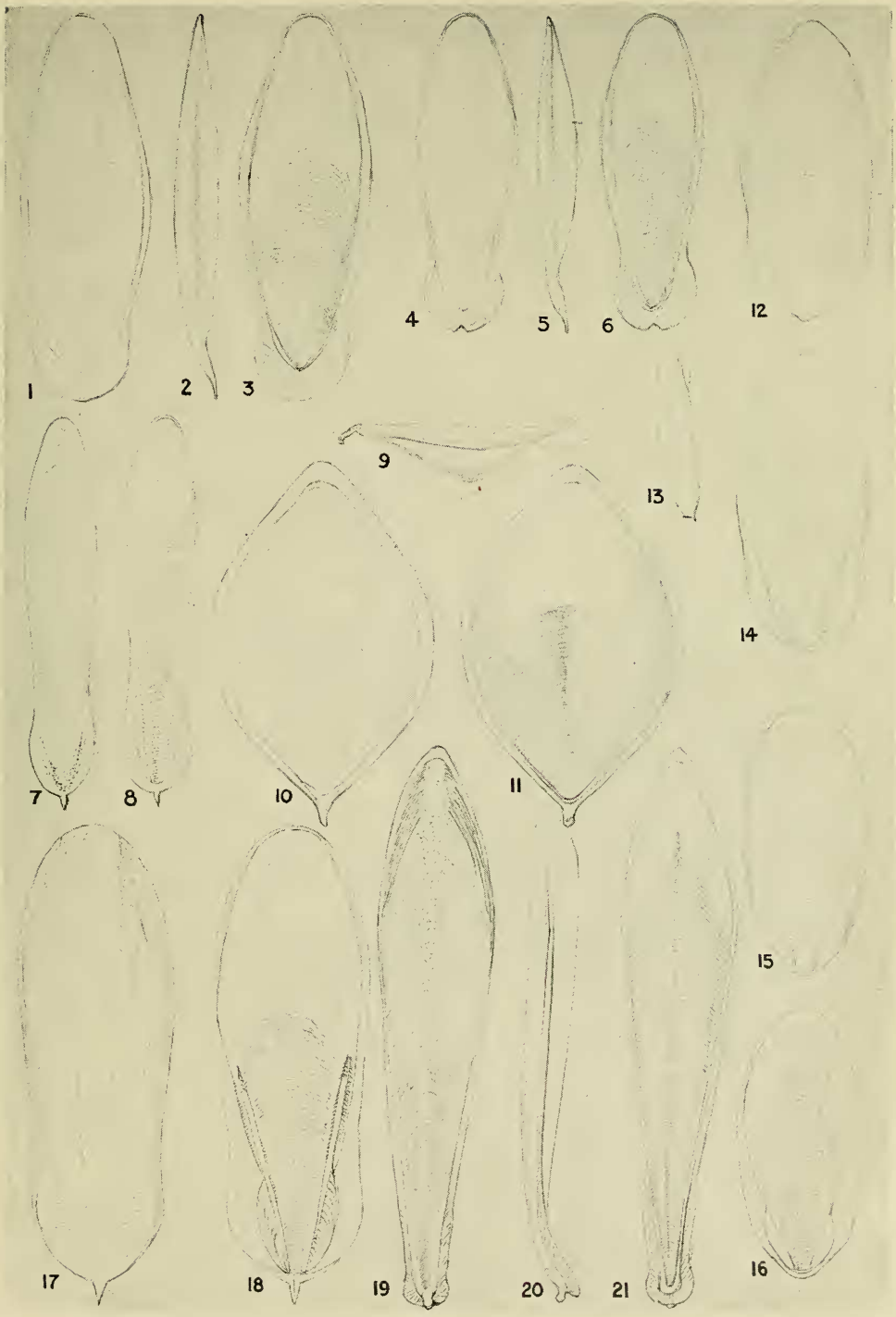
This brochure treats with the native bees found in the historic district of Portland, Victoria. Over twenty new species are described, and sub-species and allotypes of other forms recorded. In addition the author gives interesting notes on the biology of certain species. Among the parasites and commensals the author records a new species of mutillid wasp, *Ephutomorpha auricrucis,* parasitic on the larvae of *Euryglossa maculata* Sm., and refers to other species of mutillids which frequent the nests of bees. As references to these, and other insects, are made only in the general description of the bees, they are apt to be overlooked by workers specialising in groups other than the bees themselves. Where insects of other orders or families are thus mentioned, it would be in the best interests of entomology for the author to provide a brief précis at the beginning of the paper.

—A. Musgrave.



Cuttle-fish "Bones."

G. P. Whitley del



Cuttle-fish "Bones."

G. P. Whitley, del.